Appendix C
Cycle Zone Analysis Framework

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Definition of a Cycle Zone and its Purpose

A cycle zone is defined as an area of the city that possesses similar characteristics for cycling, including traffic levels, barriers, topography and other factors. Generally, a cycle zone is determined by features that represent significant barriers or crossing difficulties, such as a major interstate highway (e.g., Interstate 794). They are also defined by neighborhoods and areas that contain places that are desirable destinations for cyclists, including parks or neighborhood centers. In addition, cycle zone boundaries reflect a change in the character of a neighborhood (e.g. block size or street connectivity).

The cycle zones and their boundaries were delineated by Bicycle Federation of Wisconsin staff familiar with cycling conditions, neighborhoods, and features that represent crossing difficulties for cyclists. This resulted in six zones with boundaries determined by topographical and infrastructure barriers such as highways, rivers, and major roadways, and roughly following US Census tract delineations.. The city of Milwaukee's political limits served as the project extents for this analysis.

The goal of this effort was to use the analysis to project which areas have the greatest potential for cycling by looking at proximity to land uses, permeability of entry-exit barriers (e.g., freeway crossings), topography, connectedness of the street grid, and quantity of available bikeways to understand the relationship between cycling potential and future environmental, health and air quality benefits.

Data Gathering and Synthesis

The analysis was based on existing data provided by the Bicycle Federation of Wisconsin, and the US Census American Community Survey (2006).

The measures that were chosen and the reasoning for their inclusion in the cycle zone analysis equation are discussed in more detail below. In many cases, the selected measures were translated into density units – square acre or linear feet - to account for size variations between zones. In a few cases, such as connectivity, an overall average for the zone was used.

Total Road Network Density (Linear Feet/ Square Acre)

Definition: The density in linear feet per square acre of all roads in the cycling zone. This includes roads of all types: local streets, arterials, highways, and freeways.

Example

Dense network facilitates rider choice

Sparse network limits rider choice

Reasoning: A zone with a greater density of roads will facilitate a better cycling experience. Riders will be able to go more places and have greater route choice.

Methodology: GIS tools were used to determine the overall length of roads falling within each cycle zone. This was divided by the zone's acreage to obtain an average road network density.

Bike Network Density (Linear Feet/Square Acre)

Definition: The density in linear feet per square acre of all the City of Milwaukee's bicycle facilities within a specific cycling zone.

Example

Example bike lane

Reasoning: The presence of facilities designed for cyclists increases their comfort and safety. A greater presence of cycle facilities will improve the cycling experience.

Methodology: The bicycle network layer was intersected with the cycle zone boundary, and then the lengths of each segment or partial segment that fell within a specific zone were summed. The resulting number was divided by acreage to obtain the average density

Barrier (Average Score/Linear Feet Of Boundary)

Definition: Permeability, or ease of passage, from one zone to the next. If there is no barrier, a perfect score of six (best) is given, with a score of one (worst) given to areas that are impassable.

Example

I-405 south of downtown ranks "worst" as a barrier (Portland, OR).

Schuyler Street scores "best" and is not a barrier (Portland, OR).

Reasoning: Areas that allow easy passage and access between zones will create a better cycling experience.

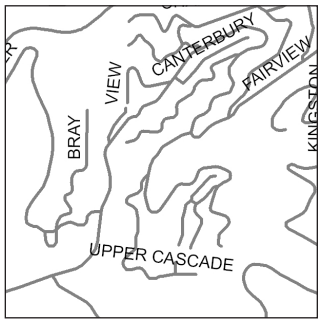
Methodology: Project staff coded approximate barrier divisions around the boundaries of each cycle zone.

The resulting data was entered into a GIS layer. The score for each boundary segment was summed and then divided by the total feet of boundary to get the average score for each zone.

Connected Node Ratio (Four-Way)

Definition: A measure of network connectivity, this number, ranging from 0 – 1, represents the ratio of cul-de-sacs and three-way intersections to four- or more-way intersections. The closer to the value of 1, the more grid-like the street pattern. An overall average score was calculated for each zone.

Example



Many dead-ends and 3-way intersections are indicators of poor connectivity.

Many 4-way intersections are indicators of good connectivity.

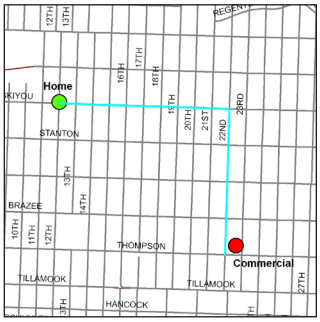
Reasoning: A zone with greater roadway connectivity will facilitate a better cycling experience. Riders will be able to easily go more places and will have greater route choice.

Methodology: GIS was used to determine all points in the city where one road was intersected by at least one other road. The location and number of roads at each intersection point were recorded. For each cycle zone, the overall number of intersections was summed, as well as the number of intersections that were at least four-way intersections. These numbers were used to determine the percentage of intersections that were four-ways or greater.

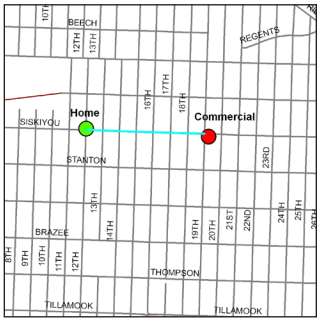
Average Network Distance to Commercial Establishments (Feet)

Definition: The average roadway network distance, measured in linear feet, from a residential tax lot to the nearest tax lot zoned for commercial use.

Example



Longer distance to commercial



Shorter distance to commercial

Reasoning: This is a proxy measure for land use mix. People are more likely to cycle in areas with many available activities. Generally, the shorter the distance from residential to commercial uses, the greater the land-use diversity.

Methodology: GIS was used to find the on-road distance from residential buildings to the nearest tax lot zoned for commercial use. The average distance was used as an overall zone measure.

Model and Zone Scores

The resulting scores for each factor for each zone are then weighted and incorporated into a model where each zone receives a score. A score of 100 is the perfect cycle zone. For this analysis each factor was assumed to have about the same amount of influence, as shown in Table 1. In some cases, such as bikeway network density, the maximum value was set above any of the observed values. The reasoning behind this decision shows that there is no zone is 'perfect' and there is always room for improvement.

Table 1: Cycle Zone Analysis Scores and Percentage Weighting

Factor Scores	Max Value*	Percentage Weight
Barrier Score / Perimeter Foot*	6	20
Road Network Per Acre	160	20
Bike Network Density (per acre)	30	20
Connectivity	1	20
Landuse Mix	742	20
Composite Zone Score		**100**